Regency® COMMUNICATIONS INC.

SERVICE MANUAL

MICRO-COM P SERIES
VHF HAND HELD TRANSCEIVER

MODELS

MICRO-COM P-H601A
MICRO-COM P-H606A
MICRO-COM P-H401A
MICRO-COM P-H406A
MICRO-COM P-H251A
MICRO-COM P-H256A

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ILLUSTRATIONS

SECTION 1 - OPERATION

1-1 TRANSCEIVER DESCRIPTION

The Regency Micro-Com P Series personal portable radio is an extremely compact, highly reliable two-way frequency modulated (FM) radio designed for operation in the 150-174 MHz frequency range. The MCP-H256A produces 2.5 watts of power output. The higher power models MCP-H406A and MCP-H606A produce 4 watts and 6 watts respectively. A separate speaker and microphone are incorporated for better audio quality. The receiver design incorporates features to assure optimum sensitivity under congested interference prone conditions. A large push-to-talk transmit switch is prominently located on the side of the case such that it may be operated conveniently by the thumb or fingers for right or left hand operation. A line of convenience accessories is available for operation and battery charging.

1-2 POWER/VOLUME CONTROL

(See Figure 2.1.) Activating the "VOL/OFF" knob in the clockwise direction applies power to the unit. Counter-clockwise is off. The VOLUME control adjusts the sound level from the speaker. Volume setting does not affect battery drain during squelched (no signal) conditions. If the unit is operated unsquelched and no signal is heard, the volume should be set as low as possible to reduce battery drain. Volume setting does not affect the transmitter signal in any way.

1-3 SQUELCH CONTROL/TONE SWITCH

Proper use of the SQUELCH control prolongs battery life between charges and prevents reception of noise and interference. Rotate the SQUELCH control counter-clockwise, but do not switch the TONE switch. Rotate the VOLUME control clockwise until a "rushing" noise is heard. Rotate the SQUELCH control clockwise to a point just past that in which the background noise is cut off (squelches). This is the normal SQUELCH control setting. Battery life is directly proportional to the amount of sound coming from the speaker. A low setting of the VOLUME control and keeping the unit "unsquelched" will produce maximum battery life. If intermittent reception is a problem, rotate the SQUELCH control counter-clockwise.

1-4 CHANNEL SELECTOR SWITCH

The CHANNEL selector switch is marked with positions A to F. This allows selection of up to six transmit and receive channels. The switch is rotated for selection of the desired channel.

1-5 MICROPHONE/SPEAKER RECEPTACLE

The MICROPHONE/SPEAKER receptacle is a six pin connector that provided for connection of an accessory speaker/mike (MA-184) and wall or mobile charger.

1-6 PUSH-TO-TALK SWITCH

To transmit, depress the PUSH-TO-TALK switch completely and hold. To receive, release the switch completely.

1-7 MICROPHONE

The MICROPHONE is located below the center of the speaker grille. While transmitting, speak into the microphone grille in a normal voice from one to two inches away.

1-8 OPERATION AT EXTENDED RANGE

To increase range between units, the following has been found effective:

(a) Orient the antenna vertically.
(b) Rotate SQUELCH control counter-clockwise allowing some background noise to be heard.
(c) Move unit away from shielding caused by nearby buildings.
(d) Elevate the unit as high as possible over the surrounding terrain.
(e) Speak slowly and distinctly into the MICROPHONE or accessory SPEAKER/MICROPHONE with your lips about one inch from the grille; do not shout.
(f) Be sure the unit has fully charged batteries.

1-9 ON CHANNEL INTERFERENCE

You might notice that stations in other nearby systems use your frequency. If the stations are quite weak and stations in your system relatively strong, you might be able to adjust the SQUELCH control on your unit to reduce the number of calls heard from stations in the other system. Use of TONE controlled squelch in your system can eliminate interference from other systems.

1-10 OPERATIONAL PRECAUTION

Reception of excessively strong signals may cause damage to the receiver. Use of this unit in close proximity to a base station antenna or closer than twenty inches from another unit is not recommended. Transmission without the antenna may cause damage to the transmitter. An antenna or a dummy load should always be connected to the ANTENNA receptacle before transmitting.

1-11 BATTERY INFORMATION

New batteries will normally reach full charge in 5 hours. Use of the MA-185 desk top charger, MA-196 wall charger or MA-195 mobile charger is recommended. Normal charge rate is 110 mA. Never exceed a 150mA charge rate.

1-12 BATTERY CONDITION INDICATOR

The LED battery condition indicator will glow during transmit with a brightness proportional to battery voltage. When battery voltage drops to less than 9 volts, the LED will not glow, thereby indicating that charging is necessary.

SECTION 2 - SPECIFICATIONS

2-1 GENERAL

Frequency range	150-174 MHz (134-174 MHz international model available)
Channels	Six
Channel spacing	30 KHz
Dimensions	6.25'(H) x 2.45"(W) x 1.8"(D) (1.58.75 x 62.2 x 45.72 mm)
Unit weight	16 oz. (0.45 kg) includes battery pack
Antenna	Rubber coated flexible
Microphone	Magnetic internal or external speaker/mike accessory (MA-184)
Power consumption	Receive: 16mA squelched 100mA at 50% of rated output Transmit: 400mA @ 1W 600mA @ 2W 800mA @ 4W 1.1A @ 6W
Power source	Nickel cadmium battery pack
Operating temperature	-30°C to +60°C
Relative humidity	+40°C - 95% or less

2-2 RECEIVER

Sensitivity	.25 microvolts for 12dB SINAD with 3 KHz deviation @ 1000 Hz .35 microvolts for 20dB quieting
Squelch sensitivity	0.25 microvolts or less @ threshold with 3 KHz deviation @ 1000 Hz
Selectivity	-75dB at ±30 KHz
Spurious and image rejection	60dB
Intermodulation rejection	60dB
Modulation acceptance bandwidth	±7.5 KHz
Frequency separation (max)	2 MHz
Audio output power	500mW @ less than 10% distortion
Frequency stability	.001% from -30°C to +60°C
Crystal frequency	(Channel frequency - 10.7)/9
Crystal type	HC 18/U or HC 25/U
Intermediate (IF) frequencies	10.7 MHz & 455 KHz

2-3 TRANSMITTER

RF output	Hi-2.5 watts, Lo-1 Hi-4 watts, Lo-1 Hi-6 watts, Lo-1 to 2 watts variable
Output impedance	50Ω
Spurious & harmonic level	-60dB
Audio frequency response	+1, -3dB per octave pre-emphasis characteristics from 300 to 3000 Hz
FM noise	-55dB below 2/3 rated deviation @ 1000 Hz
Frequency separation (max)	5 MHz

Frequency stability	.0005%-30°C to +60°C
Modulation	16F: ± KHz for 100% @ 1000 Hz
Crystal multiplication	12
Crystal type	HC 18/U or HC 25/U

2-4 POWER SUPPLY

Power source	10.8 VDC nicad battery pack, 500 maH rating
Current drain	Squelched: 15mA at 50% of rated AP out: 100 mA
Battery life	2.5 watts Hi: 10 hrs 5% transmit,5% receive, 90% standby duty cycle Lo: 13 hours 4 watts Hi: 8 hrs 5% transmit,5% receive, 90% standby duty cycle Lo: 13 hours 6 watts Hi: 7 hrs 5% transmit,5% receive, 90% standby duty cycle Lo: 12 hours

2-5 ACCESSORIES

MA-181	Rechargeable nicad battery pack
MA-182	Leather carrying case w/o TTP
MA-183	Flexible antenna
MA-184	External Speaker/microphone
MA-185	Desk top battery charger
MA-186	Touch-Tone pad (DTMF Encoder)
MA-187	CTCSS Encoder/Decoder
MA-190	6-unit desk top charger
MA-192U	Belt Clip
MA-193	TTS Decoder
MA-194	2805 Tone Decoder
MA-195	Mobile charger
MA-196	Portable wall charger
MA-199	DTMF Decoder
MA-314	2805 Touch Pad Dialer
MA-315	DTMF Touch Tone Pad w/ANI
MA-320	CTCSS Encoder

2-6 FEATURES

Physical	Light weight, small ruggedly constructed
Enclosure	High impact LEXAN front, back, top cases
State-of-the-Art design	Silicon transistors throughout, independent voltage regulation for transmitter, solid state antenna switching (no relays), two IF filters, low level audio clipping to prevent over modulation
Flexibility	External speaker/mike connector, six transmit and receive channels. Uses a nicad battery pack

SECTION 3 - CIRCUIT DESCRIPTION

3-1 GENERAL

The Regency MCP-H256A is a hand-held VHF frequency modulated (FM) transceiver that incorporates a dual conversion, superheterodyne receiver and a high power transmitter on a single glass-epoxy board. Refer to Figure 3-1 in the following circuit description.

3-2 RECEIVER

1. R.F. Amplifier

An incoming signal from the antenna is coupled through L10, L8 and L7, a low pass filter, to T1 and T2. A pin diode, D4, uncouples the receiver from the antenna during transmit. A dual-gate MOSFET is utilized in the RF amplifier. The signal is then filtered by T3 and T4, which is fed into the J-FET MIXER, Q2. T1 to T4 provide a 60dB image rejection.

2. First Local Oscillator

Q4 is a temperature compensated, crystal oscillator. The third harmonic of the crystal is picked up by T9 and used to drive Q5. The output of Q5 is filtered by T10 and T11, tuned to the 9th harmonic of the crystal, and then fed into Q2.

3. First IF Amplifier

The output of the mixer (Q2) passes through a 10.7 MHz filter consisting of YFL-1, T5 and T6 and is then amplified by Q3.

4. Second IF Amplifier and Detector

The output of Q3 is fed into IC1, which contains the second mixer, the second local oscillator, a 455 KHz IF amplifier and a quadrature detector. A 455 KHz, nine pole, ceramic filter is installed between Pin 3 and Pin 5 of IC1. The detector output is separated into audio and noise components by RC filters. The noise component is fed back into the noise amplifier section of IC1, and its output is rectified by a diode D1, and then fed back into the switching section of IC1.

5. Audio Amplifier

IC2 is a low distortion audio amplification that produces 500mW of audio output across an 8Ω speaker. While the receiver is in squelched condition, the power supply to IC2 is turned off by Q8. The appearance of a signal causes the output at Pin 13 of IC1 to go high and turn on Q7, thus turning on Q8 and IC2.

6. Receiver Switching

The output of Q6 is regulated to approximately 8 volts. When the PTT is pushed to transmit, the base of Q6 is grounded through D3, turning off the entire receiver section.

3-3 TRANSMITTER

1. Oscillator and Modulator

Q9 is a temperature compensated oscillator that incorporates NPO N470 and N750 ceramic capacitors. The effect of these capacitors against the temperature

characteristic curve of a crystal is to compensate the crystal frequency drift within FCC limits, between -30°C and +60°C. Microphone audio is amplified by Q16 and Q17, and then passed through a limited D6 and D7. The output of the limiter is integrated by C99 and R64 and then goes through a buffer amplifier Q18 which is coupled through an LC filter, into Q10, a phase modulator.

2. Frequency Multipliers

Carrier frequency is obtained with a doubler (Q11), a tripler (Q12) and a doubler (Q13). The output of each section is tuned by Hi-Q double tuned coils to insure good harmonic and spurious rejection while maintaining good band pass quality. A 5 MHz spread is possible without degrading performance of the unit.

3. Driver and Final Amplifier

The output of Q12 is amplified by Q14 and Q15. The collector voltage of Q14 is switched by a Hi-Lo switch for power output control. The output of Q15 is filtered and fed to the antenna.

4. Transmitter Switching

Q19 is in the OFF stage during receive mode. When the PTT is pushed to transmit, Q19 turns on and supplies voltage to all transmitter stages, except the final. B+ is always present at the final transistor regardless of the mode or switch position, since the power switch on the volume control can not handle the current required by the final.

BLOCK DIAGRAM

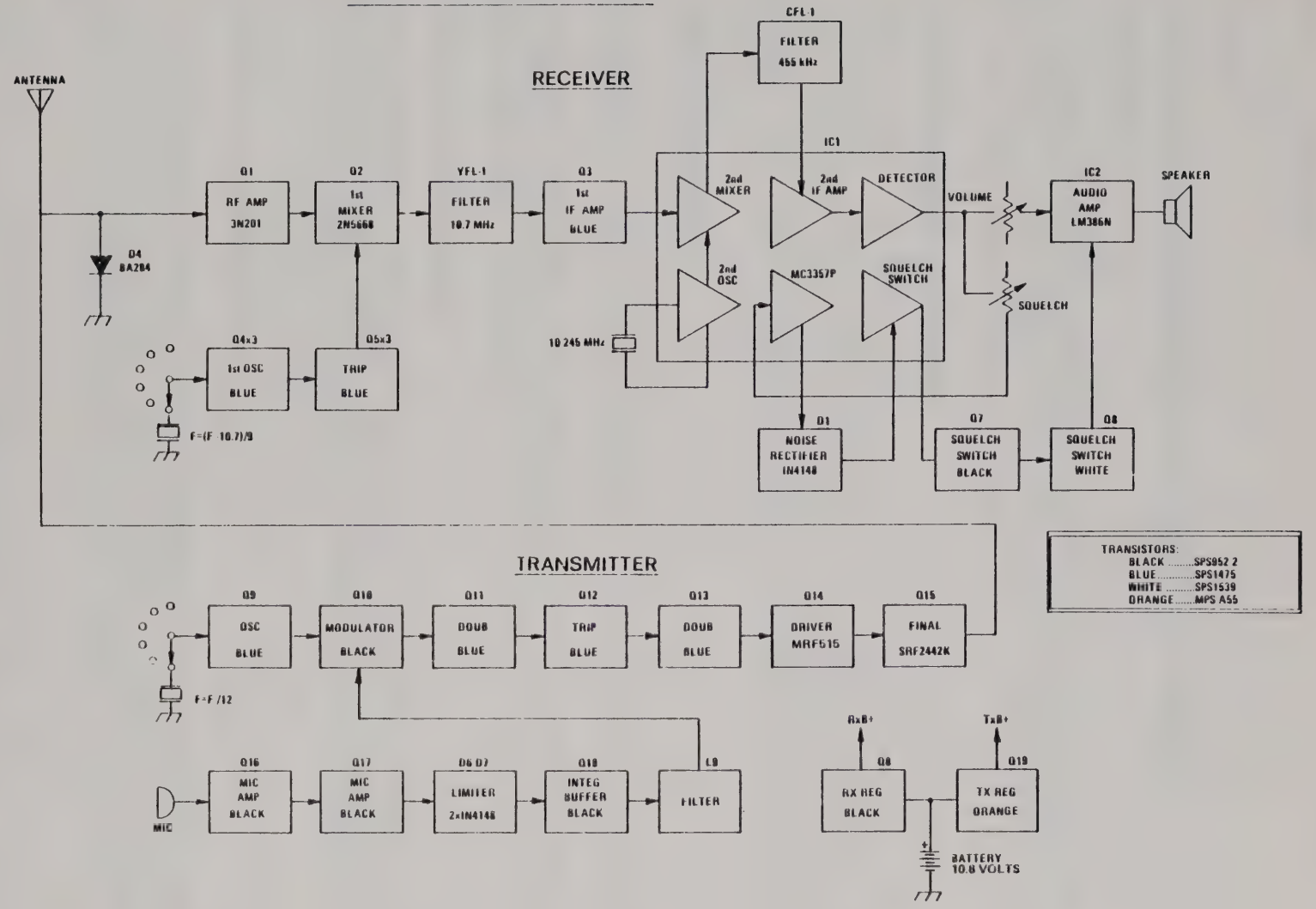


FIGURE 3-1

SECTION 4 - SERVICING

4-1 GENERAL

READ THIS SECTION CAREFULLY BEFORE SERVICING THE TRANSCEIVER

4-1-1 Disassembly

The Regency MCP-H256A transceiver consists of a single circuit board which includes transmitter and receiver components. It can be easily disassembled according to Figure 5-3. CAUTION: Do not disconnect power leads from printed circuit board before removing the battery pack.

4-1-2 General Soldering Information

The same basic soldering practices used on other printed circuit boards can be implemented. Use a 50 watt temperature controlled soldering iron. Apply the amount of heat that will cause the solder to flow quickly, but do not apply it too long. Use a small soldering tip to prevent solder bridges. Do not apply excess solder. Use a vacuum desoldering device to remove excess solder from the circuit board.

4-1-3 Tuning Information

Unnecessary tuning wastes valuable servicing time and can actually degrade the performance of a unit if not accomplished by an experienced technician.

Use proper tools only, especially for the slugs in the coil forms. Section 5 includes detailed tuning instructions. Test points referenced are locations on the circuit board only, not Jacks.

4-1-4 Preventive Maintenance

The transceiver should be put on a regular maintenance schedule, and an accurate record of its performance should be maintained. Important items to check are receiver sensitivity, transmitter frequency, deviation and power output. See Section 5 for detailed performance test.

4-2 SWITCHING MALFUNCTION

4-2-1 To incorporate an external speaker microphone, solid state switching is used in the transceiver. In case of loss of receive or transmit, check Q6 and Q19. Q6 Emitter is normally high and will go near zero when PTT is pressed. Q19 Collector will go high when PTT is pressed, to supply voltage to the transmit section.

4-2-2 Note: If Q6 Emitter voltage does not go near zero when PTT is pressed, the receiver will remain on and its local oscillator will mix with the transmitter signal, causing spurious emissions. This may occur even though the unit appears to be working normally. Check Q6 and D3 for resolution of this problem.

4-2-3 Q6 has a protection resistor in series with the emitter. In order to supply high current to transmit section, Q19 does not employ an emitter protection resistor. If Q19 is shorted, and exhibits some voltage on receive, this will disable the audio amplifier and cause no receive. Replace Q19.

4-3 RECEIVER MANFUNCTION

4-3-1 First Local Oscillator

The first oscillator, Q4, can be checked by connecting an RF probe or an oscilloscope to its emitter. If Q5 emitter voltage, measured at TP4, goes up approximately 1 volt when tuning T9, the local oscillator circuit may be working normally. If a spectrum analyzer is available, couple it to the source of Q2 and tune T10 and T11. The carrier level should be around -15dBM, and spurious emissions should be more than 40dB below carrier level.

4-3-2 Front End

In the event of excessive RF input to the front end, D4 and/or Q1 could be damaged. Check D4 with an ohm meter, and Q1 with a voltmeter, following the voltage chart.

4-3-3 10.7 MHz and 455 KHz IF

Tune an FM signal generator exactly on 10.7 MHz and apply it to the source of Q2, and check the sensitivity. It should have better than 20dB SINAD at 1μV. If not, couple the generator to the base of Q3. If the sensitivity increases, check T5, YFL1 and T6. To check IC1, follow the voltage chart. For the alignment of T5, YFL1, T6, T7 and T8, see Section 5.

4-3-4 Audio Amplifier

If the audio amplifier, IC2, is not working, make sure the squelch control is in the full CCW position. Next check the VCC voltage on Pin 6 of IC2. If there is no voltage present on Pin 6 of IC2, check Q7 and Q8, respectively, using the voltage chart as a reference.

4-4 TRANSMITTER MANFUNCTION

4-4-1 Oscillator Test

Check the line voltage along D8. It must exhibit a stable 6V, even when the supply voltage is lowered to 9 volts. Connect an RF probe to the emitter of Q9 for an oscillation check, or connect a voltmeter to TP1 and shunt the crystal momentarily. If the voltage decreases, the oscillator stage is working normally.

4-4-2 Modulator

An inexpensive oscilloscope can be used for fast signal tracing. Follow the set-up of Figure 5-1 and trace a signal from the audio generator, through the Micamps, limiter, integ-buffer and filter. When the signal is lost, the problem lies in the preceding stage.

4-4-3 Multiplier Test

Follow Section 5 transmitter alignment procedure and check voltage relationship between each test point and associated coils. Thus, it can be easily found which coil is malfunctioning. If any coil does not tune properly, check the related tuning, coupling or bypass capacitors and the coil itself. A defective coupling capacitor may cause a unit to appear to be working normally with tuning slugs at slightly different positions than normal. Generally when this occurs, spurious emissions will be excessive.

4-4-4 RF Amplifier

To check Q14 and Q15, a straight amplifier section, set up the radio as in Figure 5-1. If the oscillator and all of the multiplier stages up through Q13 check normally, the current should increase to about 200 mA by tuning T17. By tuning TC13, the current should increase to 500 mA or more. In both cases, if the current reading does not change, check Q14 and Q15. If an increase in current to 500 mA or more is noted, but no power is observed, the problem lies in the circuitry following Q15.

SECTION 5 - ALIGNMENT

5-1 GENERAL

5-1-1 Connections

Connect Test Equipment as illustrated.

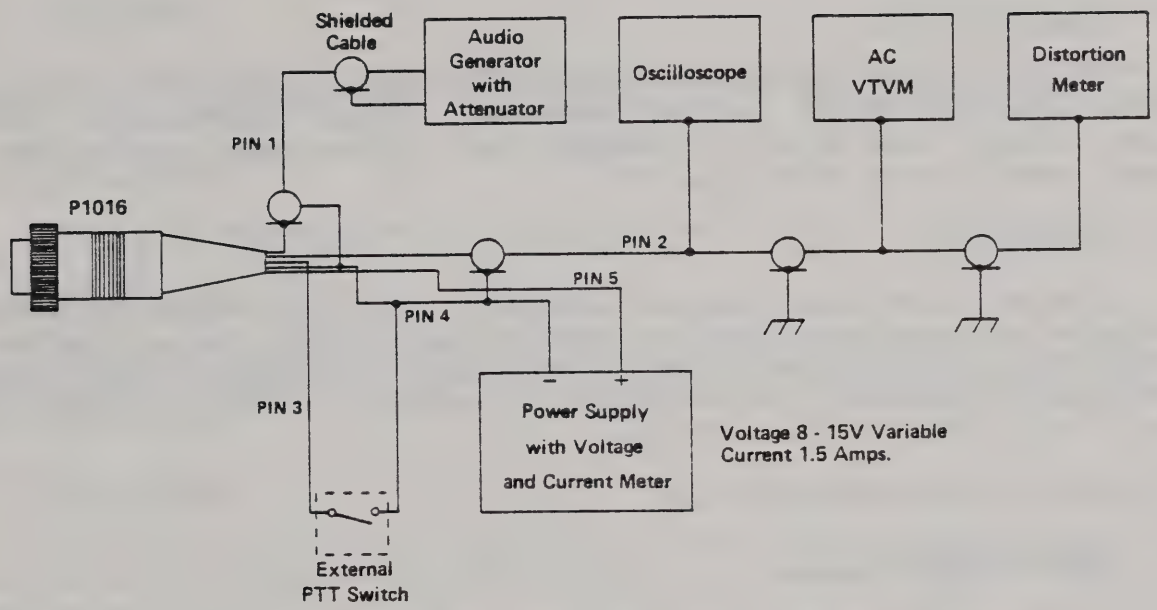


FIGURE 5-1

5-2 RECEIVER

5-2-1 Adjust the squelch control to its maximum CCW position and the volume control just far enough CW to turn the unit on.

5-2-2 Apply power to the unit. Adjust the power supply voltage to approximately 12 volts. Since power is supplied through the Mic connector, there is a voltage drop across protection diode D5. Circuit board voltage should be 11 volts.

5-2-3 Local Oscillator and Multiplier

Connect a voltmeter set to a 12 volt DC range to TP4. If a receiver crystal is oscillating, TP4 voltage should increase to approximately 1 volt by tuning T9. Connect a frequency counter to the emitter of Q4 through a few picofarad capacitors and adjust crystal trimmers to the correct frequency, which should be (FO-10.7)/9. T10 and T11 can be tuned by connecting a sensitive RF voltmeter or a spectrum analyzer at T11 output, however, the following method may be satisfactory.

5-2-4 Front End Tuning

Set the FM signal generator to the correct frequency and adjust it for a 5 KHz deviation at 1 KHz AF. Set the attenuator for about -60dBM output. Peak T10 and T11 first, then T1 to T4. Gradually turn the attenuator setting down and again peak T1 to T4 and T10 and T11.

5-2-4 IF Tuning

Increase the FM signal generator output by turning up the attenuator until the receiver produces clean audio, and check the wave form on the oscilloscope. If it is not a clean sinewave, adjust T8 (Quadrature Coil) until a clean sinewave can be seen on the scope. Turn the attenuator back down to about 1µV output and adjust T5 and T6 for minimum distortion.

5-3 RECEIVER PERFORMANCE TEST

5-3-1 Quieting Sensitivity

1. Disconnect the unit from the signal generator and turn squelch control fully CCW. Advance the volume control until the AC VTVM indicates 1 volt.

2. Reconnect the signal generator (unmodulated) and advance the attenuator until the AC VTVM reads .1 volt. This should occur at .35µV output.

5-3-2 Distortion Test

Sinad Sensitivity: Set the signal generator for .25µV output with 3 KHz deviation at 1 KHz AF, turn the volume control halfway clockwise. Set the distortion meter range control to the set level position and the range switch to the 30% position. Adjust the input sensitivity control of the meter to read 0dB. Set the range switch to distortion and null 1 KHz adjusting both tuning and null. The meter reading should drop more than 12dB.

5-3-3 Audio Output and Distortion Test

1. Set the signal generator for 1000µV output with 5 KHz deviation at 1 KHz AF.

2. Set the volume control to produce 2V RMS on the AC VTVM.

3. Set the meter range switch on the distortion meter to 100% and adjust the input sensitivity control for a full scale reading.

4. Set the range switch to distortion and balance out 1 KHz. The meter should indicate below 10 in the 10% position.

5-3-4 Squelch Sensitivity

1. Disconnect the signal generator from the unit. Set the squelch control at the threshold. Modulate the signal generator at 1 KHz with 3 KHz deviation and connect to the unit. Turn up the generator output enough to open the squelch. The attenuator reading should be approximately .2 to .3μV.

5-4 TRANSMITTER ALIGNMENT

5-4-1 Connections

Refer to Figure 5-1. Connect the antenna cable to a Bird 43 wattmeter terminated with a 50Ω dummy load. All readings are in transmit mode (PTT keyed).

5-4-2 First Doubler

Attach a DC voltmeter set for the 0-1 V range to TP1. Adjust T12 for a dip.

5-4-3 First Tripler

Attach a DC voltmeter set for the 0-2 V range to TP2. Adjust T13 for a maximum reading. Readjust T12 and T13 alternately for a maximum reading. Then adjust T14 for a dip.

5-4-4 Second Doubler

Attach a DC voltmeter set for the 0-2 V range to TP3. Adjust T15 for a maximum reading. Readjust T14, T15 alternately for a maximum reading. Then adjust T16 for a dip.

5-4-5 Driver Current

Tune T17 for a maximum deflection of the power supply meter.

5-4-6 Final

Adjust TC13 for maximum power output as observed on the wattmeter and then adjust TC14 for maximum power. Spread or squeeze coils of L1, L3 and L5 for maximum power output.

5-4-7 Frequency Adjustment

To set transmit frequency, adjust the trimmer (TC5 through TC8) for the corresponding channel.

5-4-8 Deviation Adjustment

Set the Audio Generator output for about 10 mV output at 1 KHz. Adjust VR3 to produce 5 KHz of deviation. Reduce the attenuator setting by 20dB and sweep the generator from 300 Hz to 6000 Hz. If the deviation exceeds 5 KHz at any point, readjust VR3. At 6000 Hz the deviation should be less than 1.25 KHz.

5-4-9 Power Output Setting

Set the Hi-Lo Switch to the Lo position, and adjust VR4 between .8 and 2 watts as desired.

5-5 TRANSMITTER PERFORMANCE TEST

5-5-1 Power Output and Frequency versus Power Supply Voltage

1. While keying the unit, vary the power supply voltage from 9 to 12 volts. The output frequency should not change.

2. The LED Battery Indicator should go out when voltage is reduced below 9 volts.

3. The transmitter power output should not drop more than one half when voltage is reduced to 9 volts.

5-5-2 Spurious and Harmonic Measurements

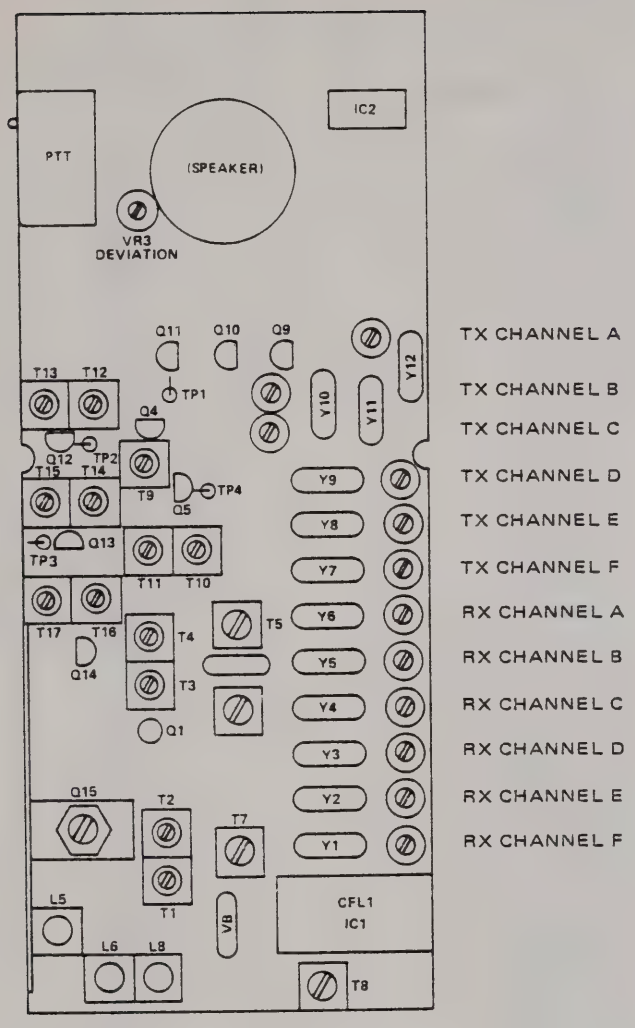
1. Connect the unit to a spectrum analyzer through an in-line 30dB power attenuator.

2. Set the analyzer for 100 MHz per division, 3 MHz resolution. The input attenuator of the analyzer should be set to the proper level. Key the unit to transmit. All spurious emissions and harmonics should be better than 50dB below the carrier on Hi position, and about 55dB on Lo position.

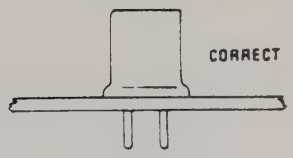
5-5-3 Antenna Test

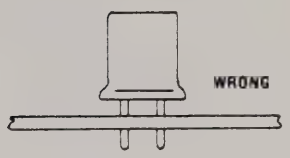
1. Connect an antenna to J1. When held in the hand, in the normal vertical position, the unit should draw approximately the same current as on a dummy load. If not, antenna length will need to be adjusted.

2. Disconnect the unit from the test jig and reassemble it back into its case. Insert a fully charged battery pack and recheck deviation, frequencies, power output and spurious and harmonic radiation.

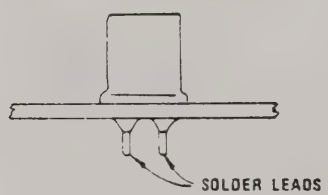


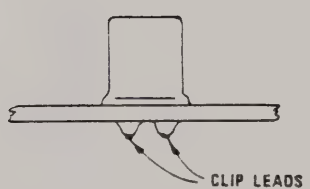
NOTE: BASE OF CRYSTAL MUST BE FLUSH WITH BOARD IN ORDER TO FIT INSIDE CASE.





SOLDER CRYSTAL LEADS BEFORE CLIPPING. CLIPPING LEADS BEFORE SOLDERING WILL DAMAGE CRYSTAL.





CRYSTAL CORRELATION

1) Holder HC18/u or HC25/u
2) Parallel resonance

$F_R = (F_O - 10.7) / 9$

$F_T = F_O / 12$

F_O = Operating frequency
F_R = Receiver fundamental frequency
F_T = Transmit fundamental frequency

3) Load capacitance 32pF both receive and transmit
4) Calibration tolerance .001%
5) Temperature tolerance .0005%, $-10^{\circ}C$ to $+60^{\circ}C$
6) Series equivalent resistance 18Ω
7) Drive level 2mw

FIGURE 5-2 CRYSTAL PLACEMENT DIAGRAM

PARTS LIST

RESISTORS

(All resistors to be 1/4Watt 5% carbon film unless otherwise stated)

REF. DESIG.	REGENCY PART NO.	DESCRIPTION
R1	4704-0223-032	22K
R2	4704-0473-032	47K
R3	4704-0221-032	220Ω
R4	4704-0220-041	22Ω 1/8W 10%
R5	4704-0332-032	3.3K
R6	4704-0183-032	18K
R7	4704-0333-032	33K
R8	4704-0152-032	1.5K
R9	4704-0224-041	220K 1/8W 10%
R10	4704-0103-041	10K 1/8W 10%
R11	4704-0103-041	10K 1/8W 10%
R12	4704-0224-041	220K 1/8W 10%
R13	4704-0103-032	10K 1/4W
R14	4704-0222-032	2.2K
R15	4704-0223-032	22K
R16	4704-0222-041	2.2K 1/8W 10%
R17	4704-0222-041	2.2K 1/8W 10%
R18	4704-0473-032	47K
R19	4704-0473-032	47K
R20	4704-0102-032	1K
R21	4704-0103-032	10K
R22	4704-0102-032	1K
R23	4704-0471-032	470Ω
R24	4704-0100-041	10Ω1/8W 10%
R25	4704-0220-032	22Ω
R26	4704-0103-032	10K
R27	4704-0103-032	10K
R28	4704-0102-032	1K
R29	4704-0472-032	4.7K
R30	4704-0333-032	33K
R31	4704-0152-032	1.5K
R32	4704-0101-032	100Ω
R33	4704-0220-032	22Ω
R34	4704-0222-032	2.2K
R35	4704-0220-032	22Ω
R36	4704-0103-032	10K
R37	4704-0103-032	10K
R38	4704-0102-032	1K
R39	4704-0472-032	4.7K
R40	4704-0103-032	10K
R41	4704-0561-032	560Ω
R42	4704-0102-032	1K
R43	4704-0101-032	100Ω
R44	4704-0562-032	5.6K
R45	4704-0333-032	33K
R46	4704-0101-032	100Ω
R47	4704-0101-032	100Ω
R48	4704-0101-032	100Ω
R49	4704-0101-032	100Ω
R50	4704-0101-032	100Ω
R51	4704-0331-041	330Ω 1/8W 10%
R52	4701-0220-041	22Ω 1/8W 10% Carbon Comp.
R53	4701-0102-041	1K 1/8W 10%
R54	4704-0222-041	2.2K 1/8W 10%

R55	4704-0222-032	2.2K
R56	4704-0102-032	1K
R57	4704-0563-032	56K
R58	4704-0102-032	1K
R59	4704-0563-032	56K
R60	4704-0182-032	1.8K
R61	4704-0562-032	5.6K
R62	4704-0123-032	12K
R63	4704-0562-032	5.6K
R64	4704-0472-032	4.7K
R65	Not Used	
R66	4704-0104-032	100K
R67	4704-0560-032	56Ω
R68	4704-0222-032	2.2K
R69	4704-0101-032	100Ω
R70	4704-0101-032	100Ω
R71	4704-0471-032	470Ω
R72	4704-0102-032	1K
R73	4704-0471-032	470Ω
R74	4704-0220-041	22Ω 1/8W 10%
R75	Not Used	
R76	Not Used	
R77	4701-0221-032	220Ω 1/4W 5% Carbon Comp.
R78	4710-0220-031	22Ω 2W 5% Wire Wound

CAPACITORS

C1	1567-0150-050	15pF Cer. NPO
C2	1567-0330-050	33pF Cer. NPO
C3	1567-0010-050-	1pF Cer. NPO
C4	1567-0070-050	7pF Cer.NPO
C5	1567-0020-050	2pF Cer. NPO
C6	1572-0102-050	.001mF Cer. YB
C7	1572-0102-050	.001mF Cer. YB
C8	1572-0102-050	.001mF Cer. YB
C9	1567-0080-050	8pF Cer. NPO
C10	1567-0057-050	.5pF Cer. SL
C11	1567-0070-050	7pF Cer. NPO
C12	1567-0330-050	33pF Cer. NPO
C13	1573-0103-050	.01mF Cer.
C14	1550-0475-016	4.7mF Tant. 16V
C15	1573-0103-050	.01mF Cer.
C16	1573-0103-050	.01mF Cer.
C17	1573-0103-050	.01mF Cer.
C18	1572-0102-050	.001mF Cer. YB
C19	1550-0105-025	1mF Tant. 25V
C20	1550-0104-035	.1mF Tant. 35V
C21	1567-0220-050	22pF Cer.NPO
C22	1567-0470-050	47pF Cer. NPO
C23	1563-0101-050	100pF Cer. N150
C24	1550-0106-016	10mF Tant. 16V
C25	1573-0223-050	.022mF Cer.
C26	1550-0104-035	.1mF Tant. 35V
C27	1550-0104-035	.1mF Tant. 35V
C28	1567-0100-050	10pF Cer. NPO
C29	1538-0471-050	470pF Axial SL-1070Y5P
C30	1538-0471-050	470pF Axial SL-1070Y5P
C31	1508-0223-050	.022mF ± 10% Mylar 50V
C32	1550-0105-025	1mF Tant. 25V
C33	1550-0104-035	.1mF Tant. 35V
C34	1508-0332-050	.0033mF ±10% Mylar 50V

C35	Not Used	
C36	1550-0105-025	1mF Tant. 25V
C37	1572-0471-050	470pF Cer. YB
C38	Not Used	
C39	1550-0105-025	1mF Tant. 25V
C40	1550-0476-016	47mF Tant. 16V
C41	1550-0476-016	47mF Tant. 16V
C42	1550-0476-016	47mF Tant. 16V
C43	1572-0102-050	.001mF Cer. YB
C44	1572-0102-050	.001mF Cer. YB
C45	1570-0201-050	200pF Cer. N750
C46	1570-0560-050	56pF Cer. N750
C47	1567-0390-050	39pF V Cer. NPO
C48	1570-0560-050	56pF Cer. N750
C49	1572-0102-050	.001mF Cer. YB
C50	1573-0103-050	.01mF Cer.
C51	1567-0010-050	1pF Cer. NPO
C52	1567-0080-050	8pF Cer. NPO
C53	1567-0080-050	8pF Cer. NPO
C54	1567-0070-050	7pF Cer, NPO
C55	1567-0050-050	5pF Cer. NPO
C56	1570-0201-050	200pF Cer. N750
C57	1570-0560-050	56pF Cer. N750
C58	1567-0470-050	47pF Cer. NPO
C59	1563-0101-050	100pF Cer. N150
C60	1563-0101-050	100pF Cer. N150
C61	1573-0103-050	.01mF Cer.
C62	1573-0103-050	.01mF Cer.
C63	1567-0470-050	47pF Cer. NPO
C64	1573-0103-050	.01mF Cer.
C65	1573-0103-050	.01mF Cer.
C66	1573-0103-050	.01mF Cer.
C67	1567-0470-050	47pF Cer. NPO
C68	1567-0040-050	4pF Cer. NPO
C69	1567-0390-050	39pF Cer. NPO
C70	1567-0330-050	33pF Cer. NPO
C71	1567-0030-050	3pF Cer. NPO
C72	1567-0270-050	27pF Cer. NPO
C73	1573-0103-050	.01mF Cer.
C74	1573-0103-050	.01mF Cer.
C75	1572-0102-050	.001mF Cer. YB
C76	1573-0103-050	.01mF Cer.
C77	1567-0070-050	7pF Cer. NPO
C78	1567-0010-050	1pF Cer. NPO
C79	1567-0100-050	10pF Cer.NPO
C80	1567-0330-050	33pF Cer. NPO
C81	1572-0102-050	.001mF Cer. YB
C82	1550-0475-016	4.7mF Tant. 16V
C83	1567-0220-050	22pF Cer. NPO
C84	1567-0390-050	39pF Cer. NPO
C85	1550-0475-016	4.7mF Tant.16V
C86	1572-0102-050	.001mF Cer. YB
C87	1567-0390-050	39pF Cer. NPO
C88	1567-0390-050	39pF Cer. NPO
C89	1567-0150-050	15pF cer Cer. NPO
C90	1572-0471-050	470pF Cer. YB
C91	1572-0102-050	.001mF Cer. YB
C92	1550-0475-016	4.7mF Tant. 16V
C93	1572-0471-050	470pF Cer. YB
C94	1572-0471-050	470pF Cer. YB
C95	1550-0475-016	4.7mF Tant. 16V
C96	1550-0104-035	.1mF Tant. 35V
C97	1572-0471-050	470pF Cer. YB

C98	1550-0475-016	4.7mF Tant. 16V
C99	1550-0154-035	.15mF Tant. 35V
C100	1550-0475-016	4.7mF Tant. 16V
C101	1572-0102-050	.001mF Cer. YB
C102	1572-0102-050	.001mF Cer. YB
C103	1550-0154-035	.15mF Tant. 35V
C104	1550-0475-016	4.7mF Tant. 16V
C105	1550-0476-016	47mF Tant. 16V
C106	1572-0102-050	.001mF Cer. YB
C107	1572-0102-050	.001mF Cer. YB
C108	1573-0103-050	.01mf Cer.
C109	Not Used	
C110	Not Used	
C111	1567-0470-050	47pF Cer. NPO
C112	1567-0470-050	47pF Cer. NPO
C113	1567-0470-050	47pF Cer. NPO
C114	1567-0470-050	47pF Cer. NPO
C115	1567-0470-050-	47pF Cer. NPO
C116	1567-0470-050	47pF Cer. NPO
C117	1567-0470-050	47pF Cer. NPO
C118	1567-0470-050	47pF Cer. NPO
C119	1567-0470-050	47pF Cer. NPO
C120	1567-0470-050	47pF Cer. NPO
C121	1567-0470-050	47pF Cer. NPO
C122	1567-0470-050	47pF Cer. NPO
C123	1569-0100-050	10pF Cer. N470
C124	1567-0150-050	15pF Cer. NPO
C125	1572-0102-050	.001mF Cer. YB
TC1 Thru TC14	1517-0200-050	20pF Trimmer

TRANSISTORS

Q1	4804-0870-890	IGFET 3N201
Q2	4804-0870-700	2N5668
Q3	4801-0000-003	BLUE TOP SPS1476
Q4	4801-0000-003	BLUE TOP SPS1476
Q5	4801-0000-003	BLUE TOP SPS1476
Q6	4801-0000-016	BLACK TOP SPS952-2
Q7	4801-0000-016	BLACK TOP SPS952-2
Q8	4801-0000-060	WHITE TOP SPS1539
Q9	4801-0000-003	BLUE TOP SPS1476
Q10	4801-0000-016	BLACK TOP SPS952-2
Q11	4801-0000-003	BLUE TOP SPS1476
Q12	4801-0000-003	BLUE TOP SPS1476
Q13	4801-0000-003	BLUE TOP SPS1476
Q14	4801-0800-025	MPS3866A
Q15	4801-0873-000	SRF2442K 2N5945
Q16	4801-0000-016	BLACK TOP SPS952-2
Q17	4801-0000-016	BLACK TOP SPS952-2
Q18	4801-0000-016	BLACK TOP SPS952-2
Q19	4801-0000-001	ORANGE MPS-A55
Q20		

INTERGRATED CIRCUITS

IC-1	3130-0860-000	MC-3357P-1
IC-2	3130-0860-020	LM-386N-1

THERMISTORS

TH1	5300-0805-150	500Ω Thermistor10% Y Curve

DIODES

D1	4805-1241-200	IN4148 DO-35
D2	4808-0000-029	IN757A DO-35 9V Zener
D3	4805-1241-200	IN4148 DO-35
D4	4805-0851-060	BA-284 Pin
D5	4806 -0000-004	IN4002 DO-41
D6	4805-1241-200	IN4148 DO-35
D7	4805-1241-200	IN4148 DO-35
D8	4808-0000-025	IN753A DO-35 6.2V Zener
D9	4808-0000-025	IN753A DO-35 6.2V Zener
D10	4810-0851-460	MV-5075B Light Emitting
D11	Not Used	
D12	Not Used	
D13	4806-0000-004	IN4002 DO-41

COILS

L1	1801-0826-595	L2659A Airwound
L2	1801-0826-580	L2658 Airwound
L3	1806-0826-560	L2656 RFC
L4	1803-0826-800	L2680 100K 1/4 W RFC
L5	1801-0826-770	L2677 Airwound
L6	1801-0826-790	L2679 Airwound
L7	1801-0826-780	L2678 Airwound
L8	1801-0826-790	L2679 Airwound
L9	1802-0223-010	22mH Choke
L10	1801-0826-590	L2659 Airwound

TRANSFORMERS

T1	5601-0826-660	L2666 Transformer
T2	5601-0826-660	L2666 Transformer
T3	5601-0826-660	L2666 Transformer
T4	5601-0826-660	L2666 Transformer
T5	5601-0826-730	L2673 Transformer
T6	5601-0826-730	L2673 Transformer
T7	5601-0826-730	L2673 Transformer
T8	5601-0826-570	L2657 Transformer
T9	5601-0826-610	L2661 Transformer
T10	5601-0826-740	L2674 Transformer
T11	5601-0826-750	L2675 Transformer
T12	5601-0826-620	L2662 Transformer
T13	5601-0826-630	L2663 Transformer
T14	5601-0826-640	L2664 Transformer
T15	5601-0826-650	L2665 Transformer
T16	5601-0826-660	L2666 Transformer
T17	5601-0826-670	L2667 Transformer

POTENTIOMETERS

VR1/S3	4750-0857-760	20K W/Switch
VR2	4750-0857-720	5K W/Switch
VR3	4751-0503-100	50K Trimmer
VR4	4751-0103-100	10K Trimmer

SWITCHES

S1	5111-0867-420	Rotary 6 Pos, 2 Pole
S2	5116-0867-600	Micro AH2504 3A, 250V
S3	P/O VR1	
S4	5114-0867-820	Toggle SPST TT11DG

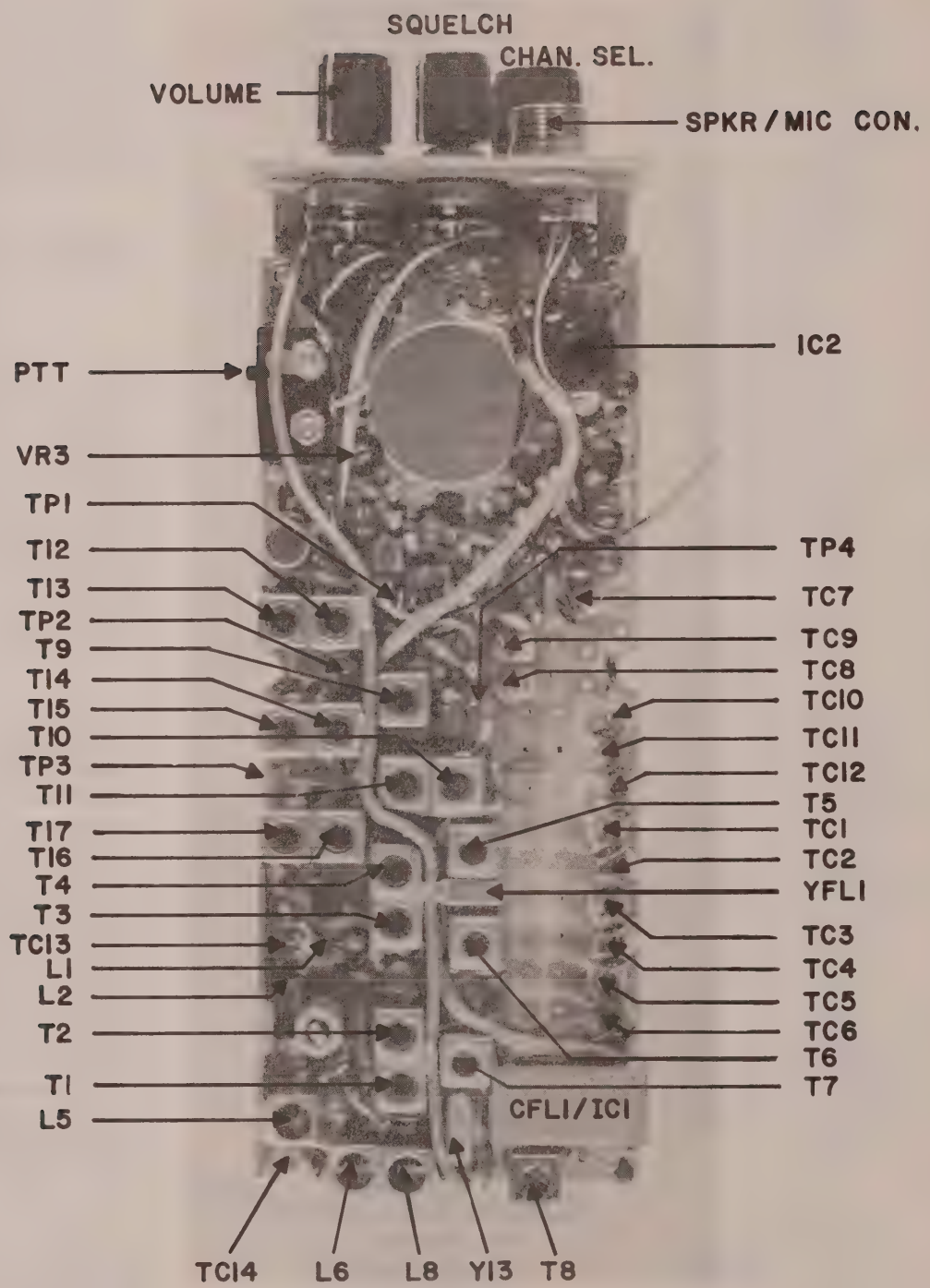
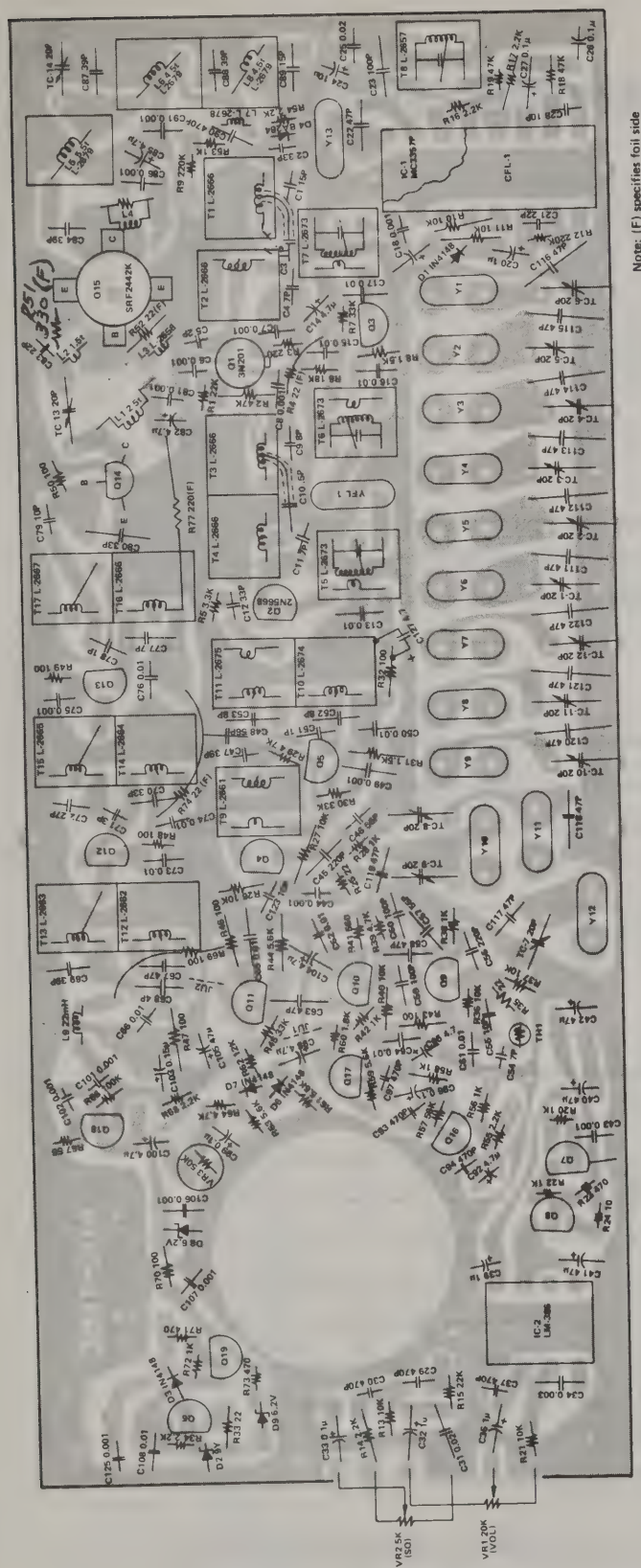
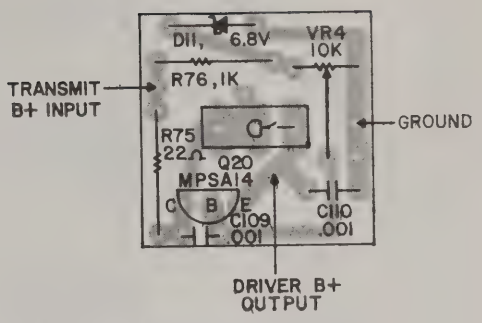


FIGURE 5-4

PARTS PLACEMENT

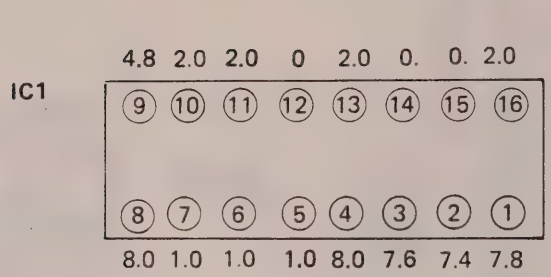


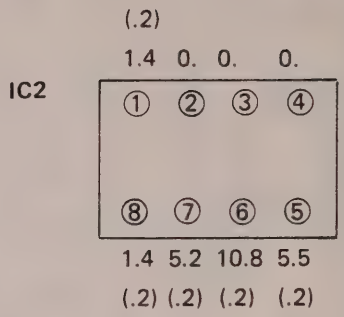


OUTPUT POWER REGULATOR

PARTS OVERLAY

VOLTAGE MEASUREMENTS





RECEIVER:

FET'S	G1	G2	S	D
Q1	0	2.4	0.8	7.8
Q2	0		0.8	8.0

TRANSISTORS	E	B	C
Q3	2.0	2.7	8.0
Q4	3.6	3.0	7.6
Q5	0.2	0.8	7.61
Q7	0	0.7(0)	0(10.6)
Q8	10.8(10.7)	10.0(10.7)	10.8(1.6)

( ) indicates squelch closed

TRANSMITTER:

TRANSISTORS	E	B	C
Q9	2.6	3.0	6.0
Q10	1.4	2.0	3.7
Q11	0.40	0.8	6.0
Q12	1.8	0	9.3
Q13	1.5	0	10.6
Q14	0	-0.3	9.0
Q15	0	0	10.6
Q16	0	0.6	1.0
Q17	2.5	3.2	3.8
Q18	0	0.70	1.8

SWITCHING:

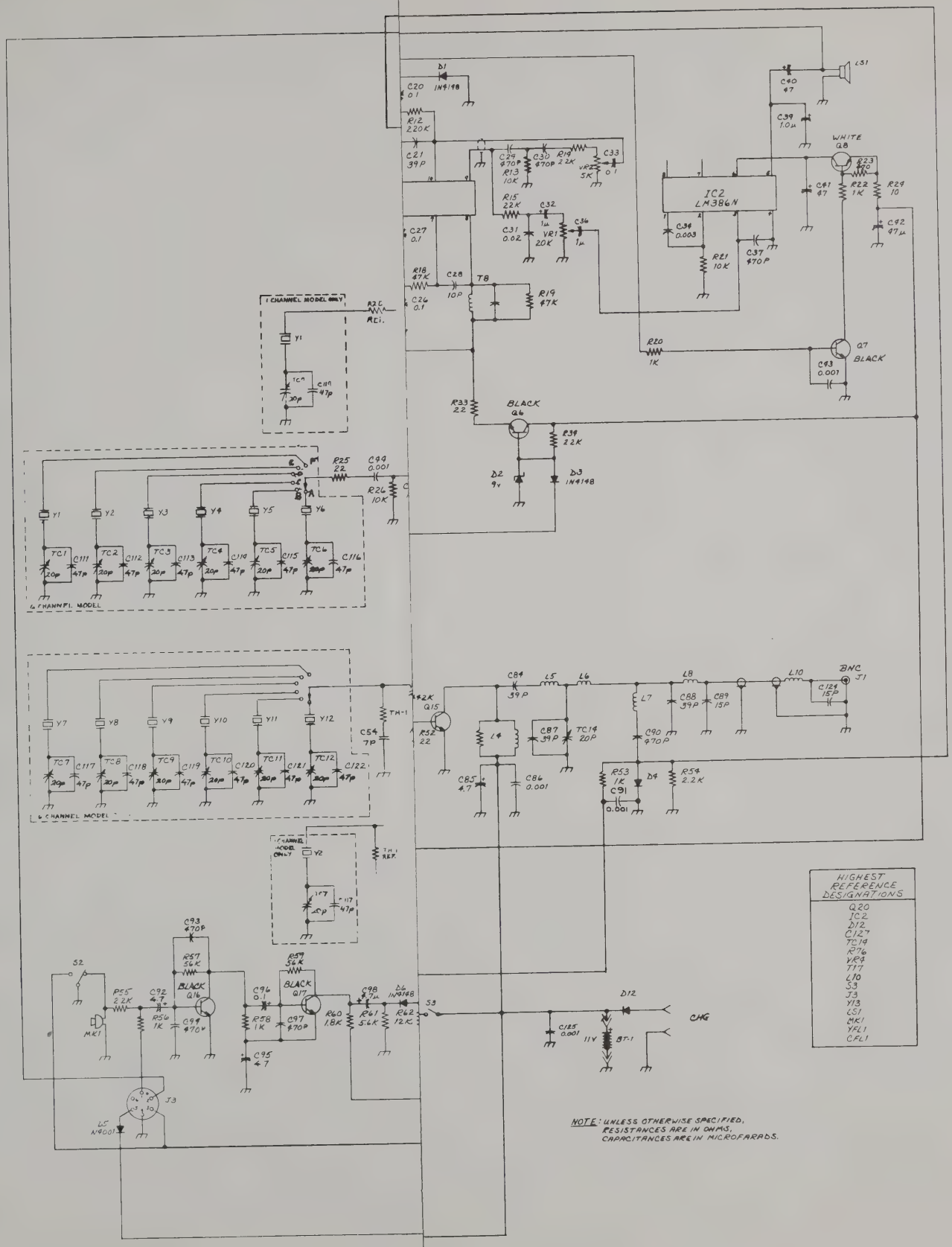
TRANSISTORS	E	B	C
Q6	8.30(0)	9.0(0.6)	11.0(10.6)
Q19	11.0(10.6)	11(9.9)	0(10.5)

( ) indicates transmit mode

Transmitter with full power output

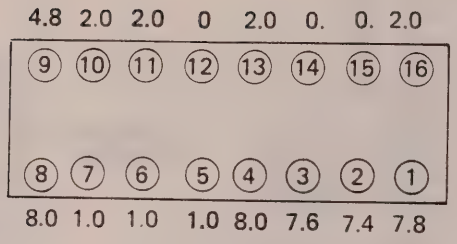
Measurements done by 11.0V
supply voltage.

Measured by 50K ohm/V DC voltmeter

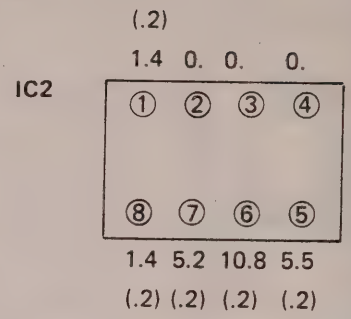

IC2
LM386N
WHITE
Q8
BLACK
Q6
BLACK
Q7
1 CHANNEL MODEL ONLY
6 CHANNEL MODEL
6 CHANNEL MODEL
1 CHANNEL MODEL ONLY
BNC
J1
CHG
HIGHEST REFERENCE DESIGNATIONS
Q20
IC2
D12
C127
TC14
R76
VR9
T17
L10
S3
J3
Y13
LS1
MK1
YFL1
CFL1
NOTE: UNLESS OTHERWISE SPECIFIED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN MICROFARADS.

VOLTAGE MEASUREMENTS

IC1



IC2



RECEIVER:

FET'S	G1	G2	S	D
Q1	0	2.4	0.8	7.8
Q2	0		0.8	8.0

TRANSISTORS	E	B	C
Q3	2.0	2.7	8.0
Q4	3.6	3.0	7.6
Q5	0.2	0.8	7.61
Q7	0	0.7(0)	0(10.6)
Q8	10.8(10.7)	10.0(10.7)	10.8(1.6)

( ) indicates squelch closed

TRANSMITTER:

TRANSISTORS	E	B	C
Q9	2.6	3.0	6.0
Q10	1.4	2.0	3.7
Q11	0.40	0.8	6.0
Q12	1.8	0	9.3
Q13	1.5	0	10.6
Q14	0	-0.3	9.0
Q15	0	0	10.6
Q16	0	0.6	1.0
Q17	2.5	3.2	3.8
Q18	0	0.70	1.8

SWITCHING:

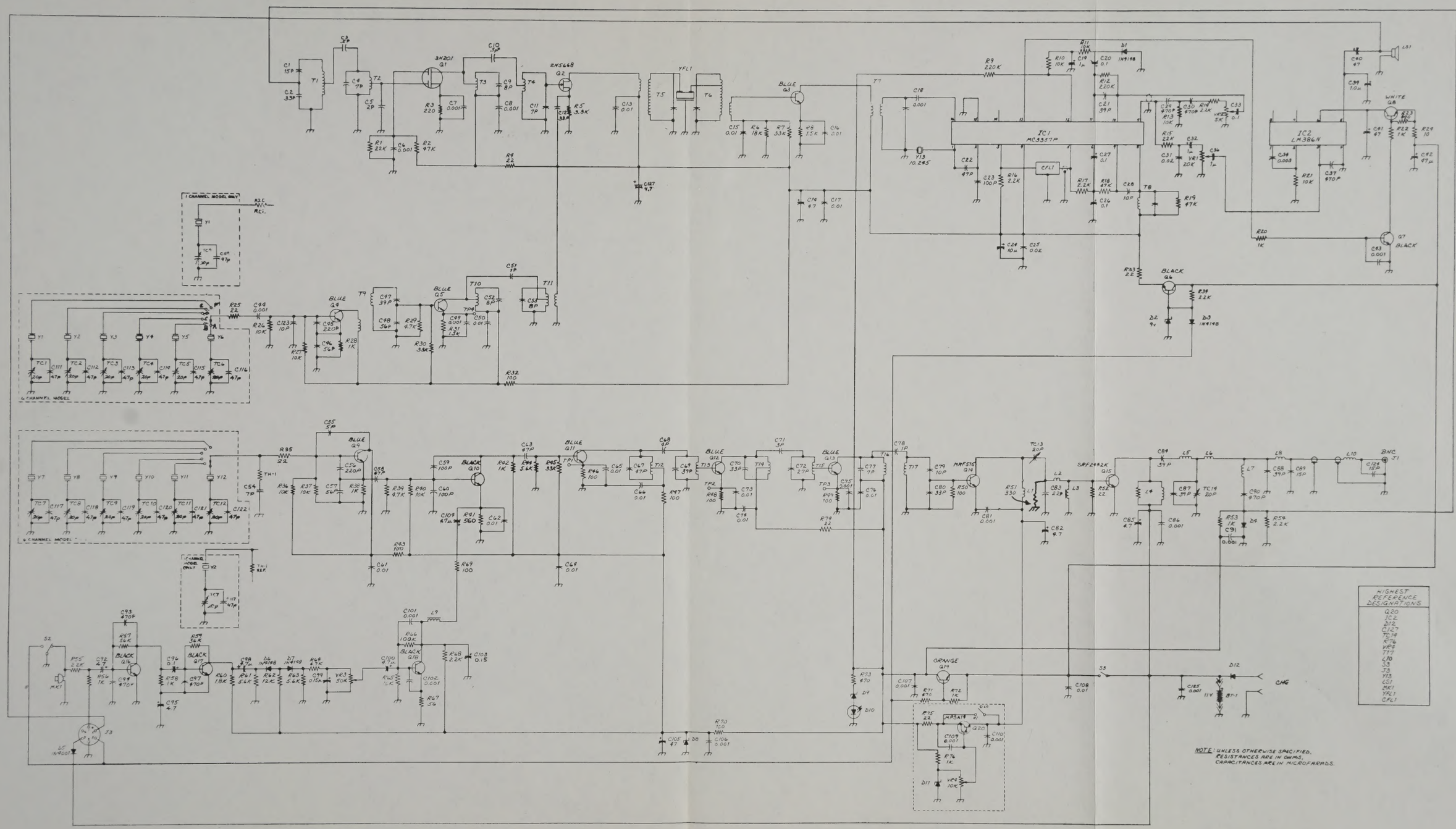
TRANSISTORS	E	B	C
Q6	8.30(0)	9.0(0.6)	11.0(10.6)
Q19	11.0(10.6)	11(9.9)	0(10.5)

( ) indicates transmit mode

Transmitter with full power output

Measurements done by 11.0V
supply voltage.

Measured by 50K ohm/V DC voltmeter



SCHEMATIC

MCPHA SERIES